



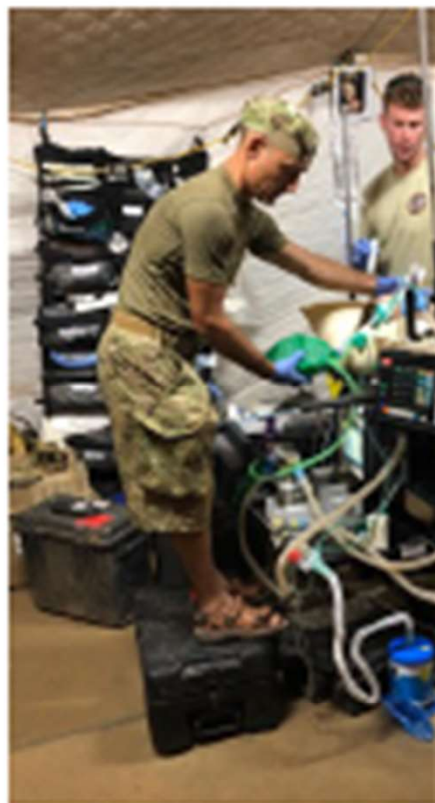
Strategic
Command

Transfusion management from a Military and NHS perspective:

The same but different?

Lt Col Paul Moor RAMC

Consultant Anaesthetist
Clinical Lead Blood Far Forward



Scope

- Significance of haemorrhage and need for blood
- Key Concepts in haemorrhage
- Innovation
- Military Civilian collaboration

WHY DO INJURED SERVICE PERSONNEL DIE?

Why do we die on the Battlefield?

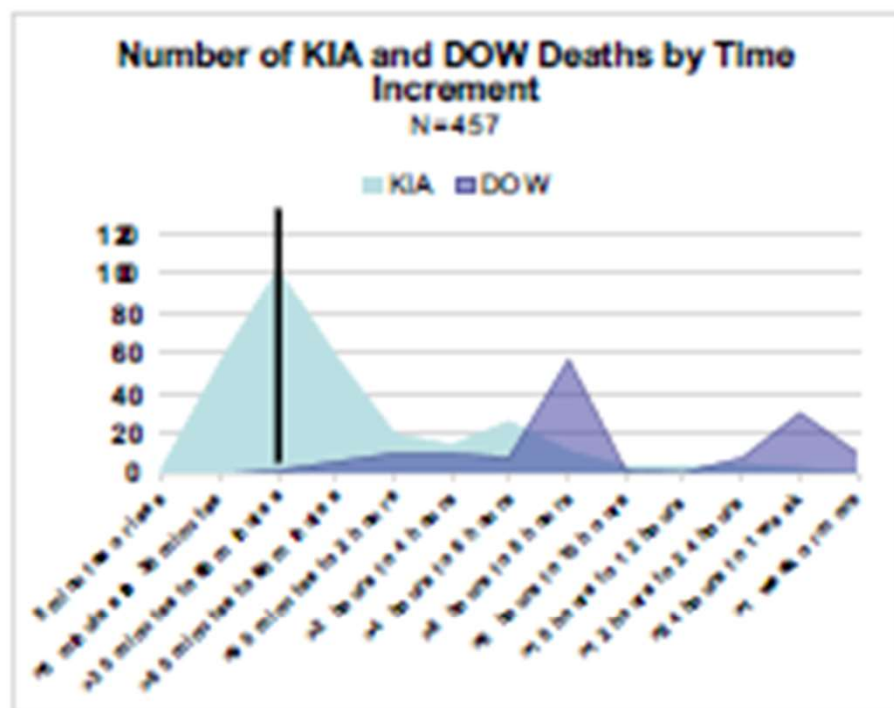
- Death on the battlefield is due to 3 major causes
 - Total body disruption
 - Significant head injury
 - Haemorrhage
 - Preventable/Reversible
 - Haem Control
 - Blood volume Restoration & Resuscitation

1. Keene DD, Penn-Barwell JH, Wood PR, Hunt N, Delaney K, Cleaver J, et al. Died of wounds: a mortality review. *J R Army Med Corps*. 2018 Oct;162(5):355-60.

2. Eastidge RJ, Mabry RL, Seguin P, Corbett J, Topp T, Uribe P, et al. Death on the battlefield (2001-2011): implications for the future of combat casualty care. *J Trauma Acute Care Surg*. 2012 Dec;73(6 Suppl 5):S431-7.

3. Eastidge RJ, Hainli M, Corbett J, Cullen-Grimes L, Zubin T, Malak C, et al. Died of wounds on the battlefield: causation and implications for improving combat casualty care. 2011 Jul;71(1 Suppl):S4-8.

When do people die?



Shackelford, et al. JTS 2016



DSTL

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Killed in action (KIA): an analysis of military personnel who died of their injuries before reaching a definitive medical treatment facility in Afghanistan (2004–2014)

Stacey Webster,^{1,2} E B G Barnard ^{1,3} J E Smith ¹ M E R Marsden ^{4,5}
C Wright¹

BMJ

Webster S, et al. *BMJ Mil Health* 2020;0:1–5. doi:10.1136/bmjrmil-2020-001493

- 348 KIAs
- Med ISS 75.0 (55.5–75.0)
- Median time to death 0.0 (IQR 0.0–21.8) min

THE NEED FOR BLOOD

ARTICLES



Resuscitation with blood products in patients with trauma-related haemorrhagic shock receiving prehospital care (RePHILL): a multicentre, open-label, randomised, controlled, phase 3 trial



Nicholas Gensler, Heidi A Doughty, Jonathan R B Bishop, Anisha Desai, Emily F Dobson, James M Hancock, Mike J Herbert, Catherine Leach, Simon J Lewis, Mark R Moxh, David N Mousavari, Gervase Sling, Hazel Smith, Iain M Smith, Rebekah K Wolfe, Alexander Wilson, Nadine Ives, Gavin D Perkins, on behalf of the RePHILL collaborative group*

Summary

Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival

Stacy A. Shackelford, MD; Deborah J. del Junco, PhD; Nicole Powell-Dunford, MD; Edward L. Mazuchowski, MD, PhD; Jeffrey T. Howard, PhD; Russ S. Kotwal, MD, MPH; Jennifer Gomez, MD; Frank K. Butler Jr, MD; Kirby Gress, MD; Zsolt T. Stockinger, MD

US military combat casualties in Afghanistan over 3 years in the early twenty teens

Retrospective cohort study.

Effect transfusion and it's timing on mortality

Inclusion:-

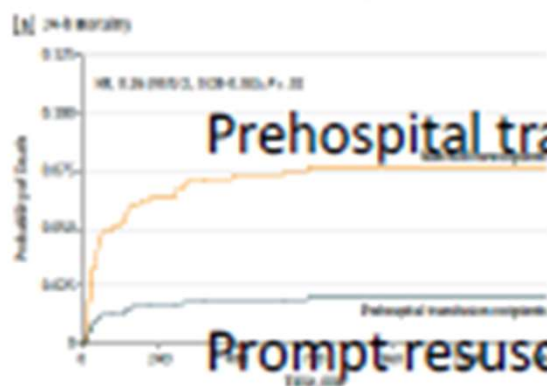
1. traumatic limb amputation at or above the knee or elbow

or

2. shock defined as a systolic blood pressure of less than 90 mm Hg or HR > 120bpm

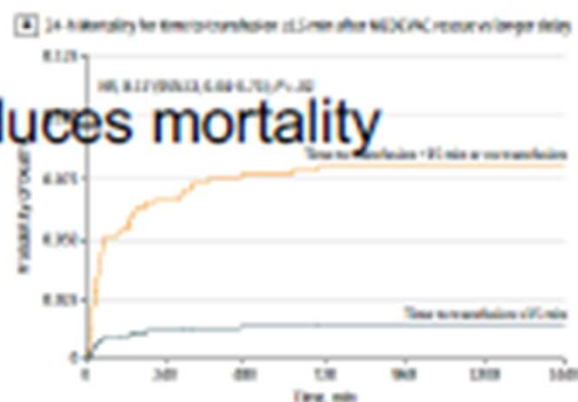
Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival

Stacy A. Shackelford, MD; Deborah J. del Junco, PhD; Nicola Powell-Dunford, MD; Edward L. Mazuchowski, MD, PhD; Jeffrey T. Howard, PhD; Russ S. Kotwal, MD, MPH; Jennifer Gurney, MD; Frank K. Butler Jr, MD; Kirby Gross, MD; Zsolt T. Stockinger, MD



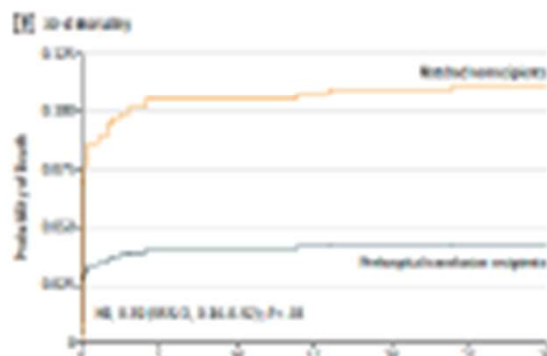
Prehospital transfusion reduces mortality

Figure 4. Mortality by Time From Medical Evacuation (MEDEVAC) Request to Start of Transfusion



Prompt resuscitation reduces mortality

HR	95% CI	P
0.26	(0.18-0.38)	<.01



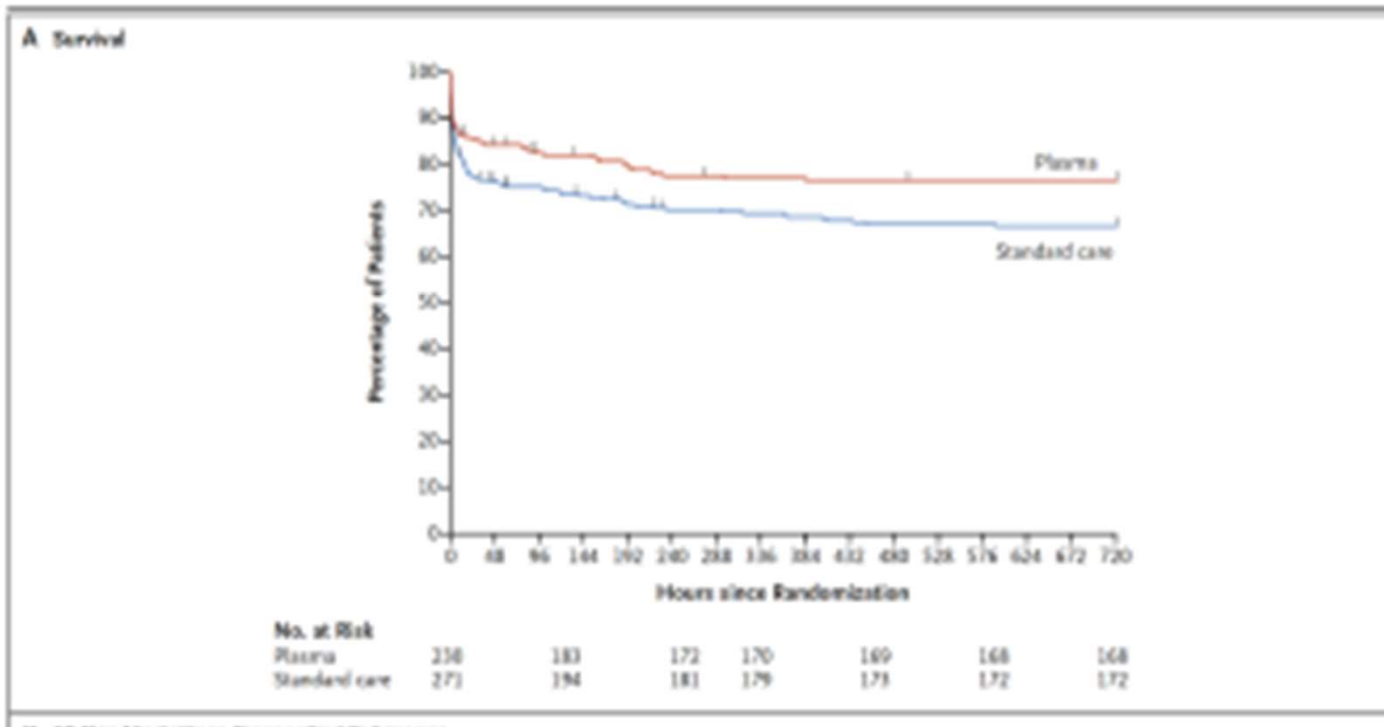
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PAMPER

Pre Hospital Plasma during Air Medical Transport in Trauma patients at risk of Hypovolaemic shock

- **Clinical Question** In severely injured patients at risk for haemorrhagic shock, does prehospital plasma resuscitation, compared with standard-care resuscitation (not including plasma administration), reduce 30-day mortality?
- Pragmatic, phase 3, multicentre, cluster-randomized trial 3 yr data capture n 496
- Pan US Air services block randomised for universal thawed plasma or saline for qualifying shocked trauma patients. Sperry et al. NEJM. Published 26th July, 2018. N Engl J Med 2018;379:315-26. DOI: 10.1056/NEJMco

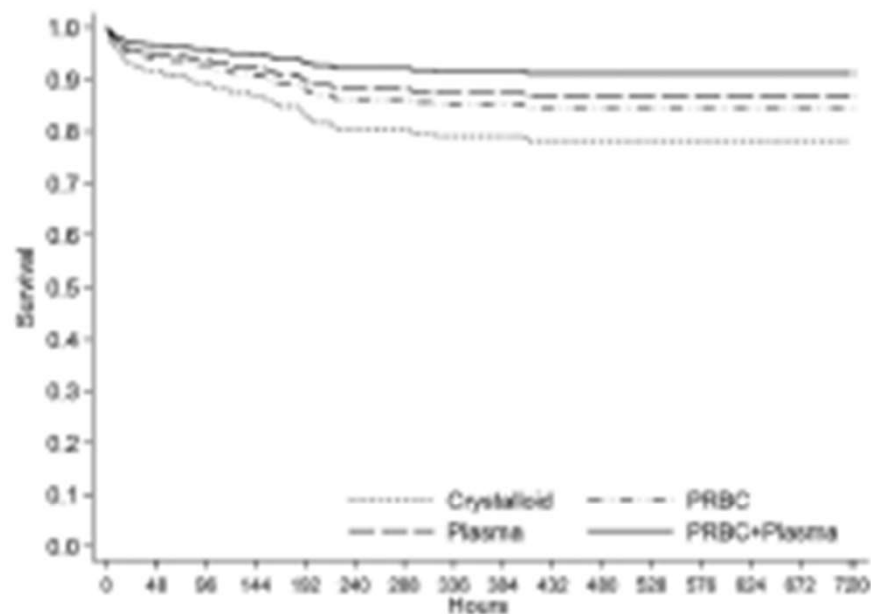
PAMPER



Secondary analysis PAMPER

Gavira et al

Annals of Surgery • Volume XX, Number XX, Month 2019



PRBC + Plasma

Plasma

PRBC

Crystalloid

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Where do we need blood & it's components?



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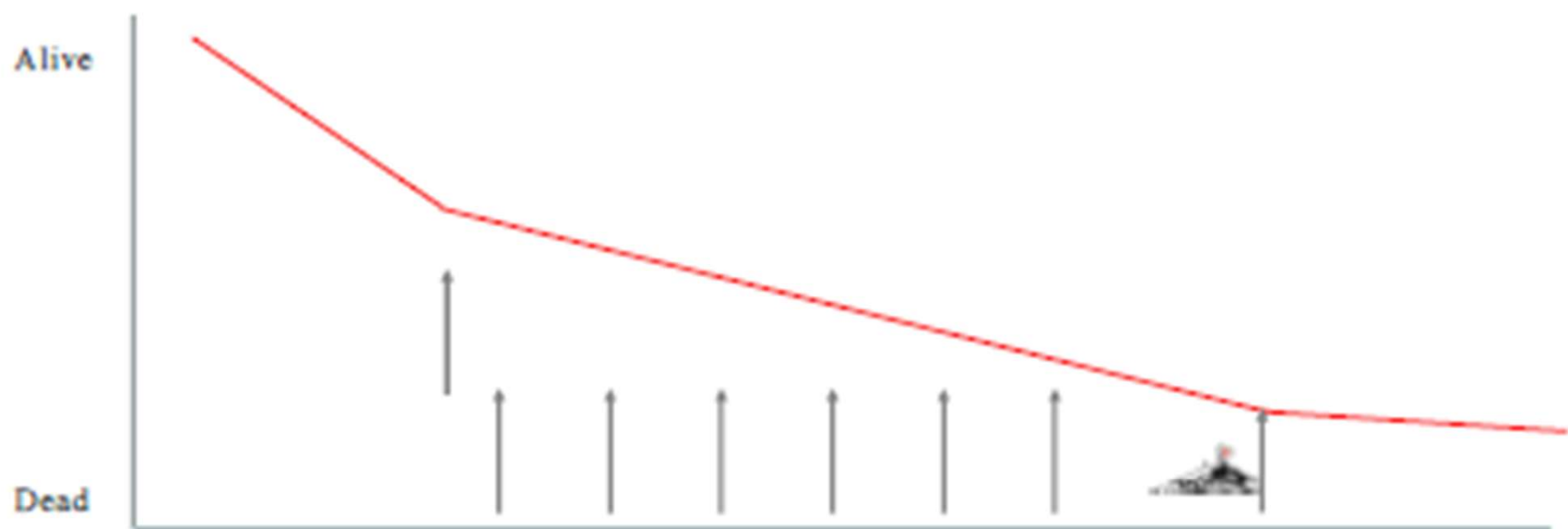
Alive

Dead



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THE CHALLENGE?

Haemorrhage is a Team sport!

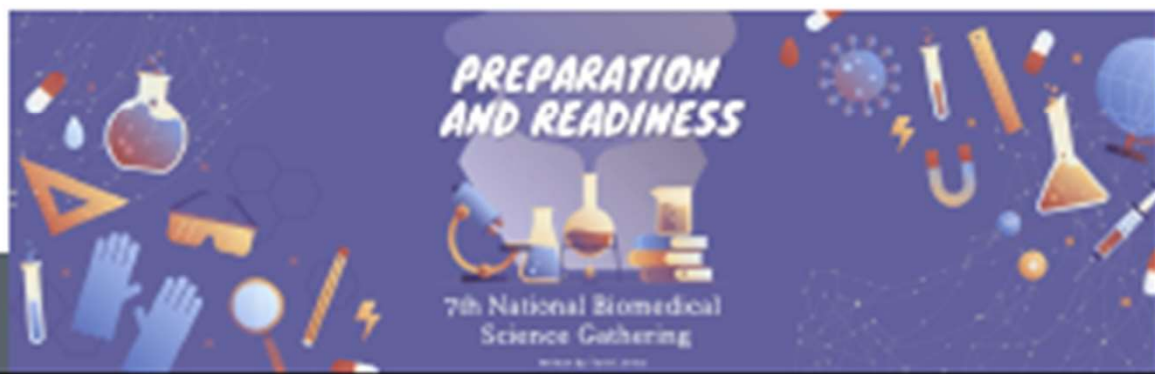


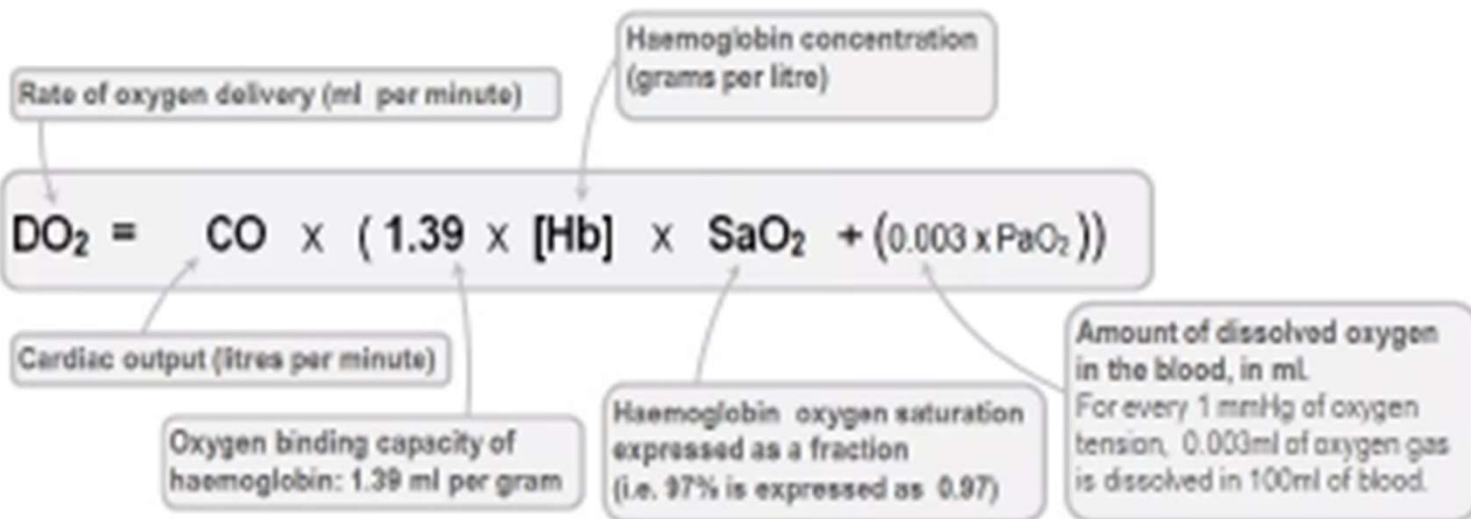
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Major Haemorrhage requirements

- Pre-emptive / Anticipatory Mindset
- Patient
- ED/Theatre/Anaesthesia
- Laboratory/Institution
- Logistics!





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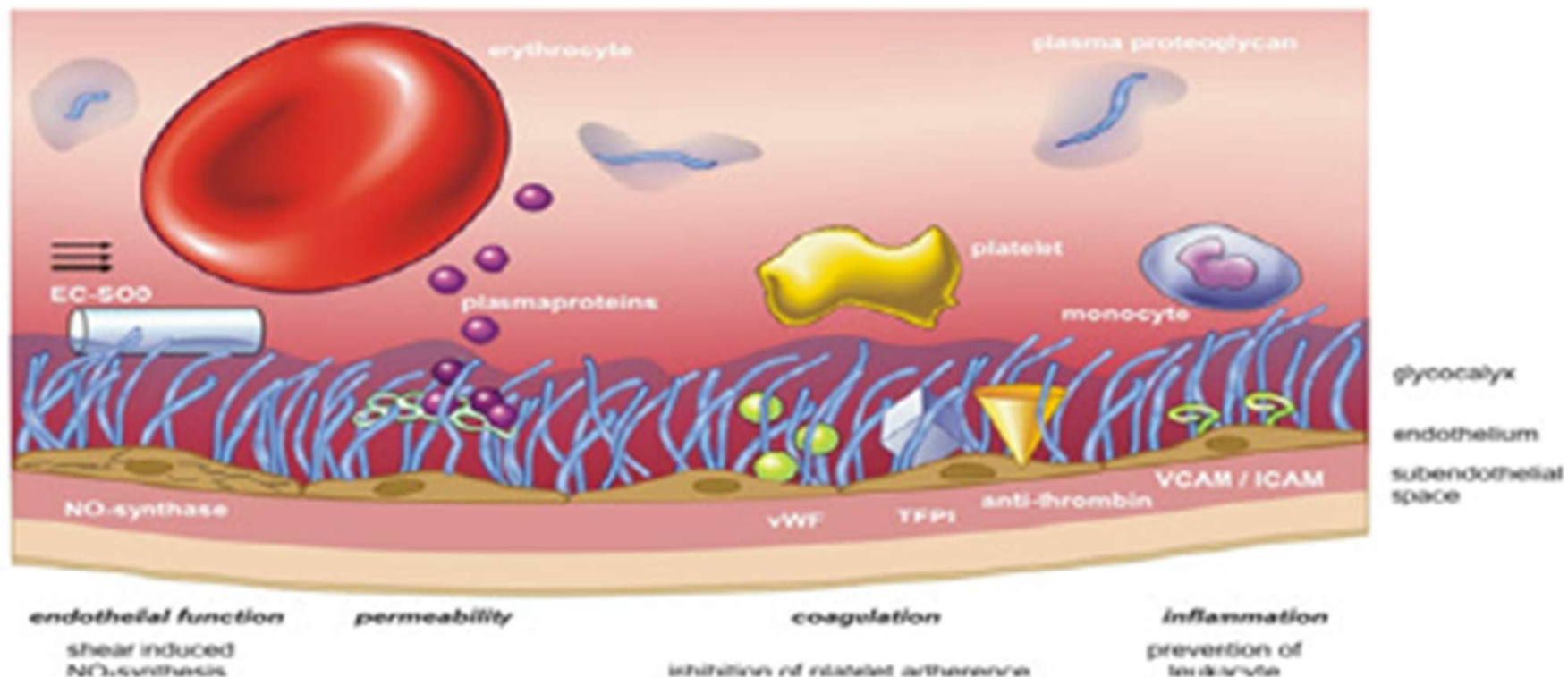
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Mitigate the physiological
insult

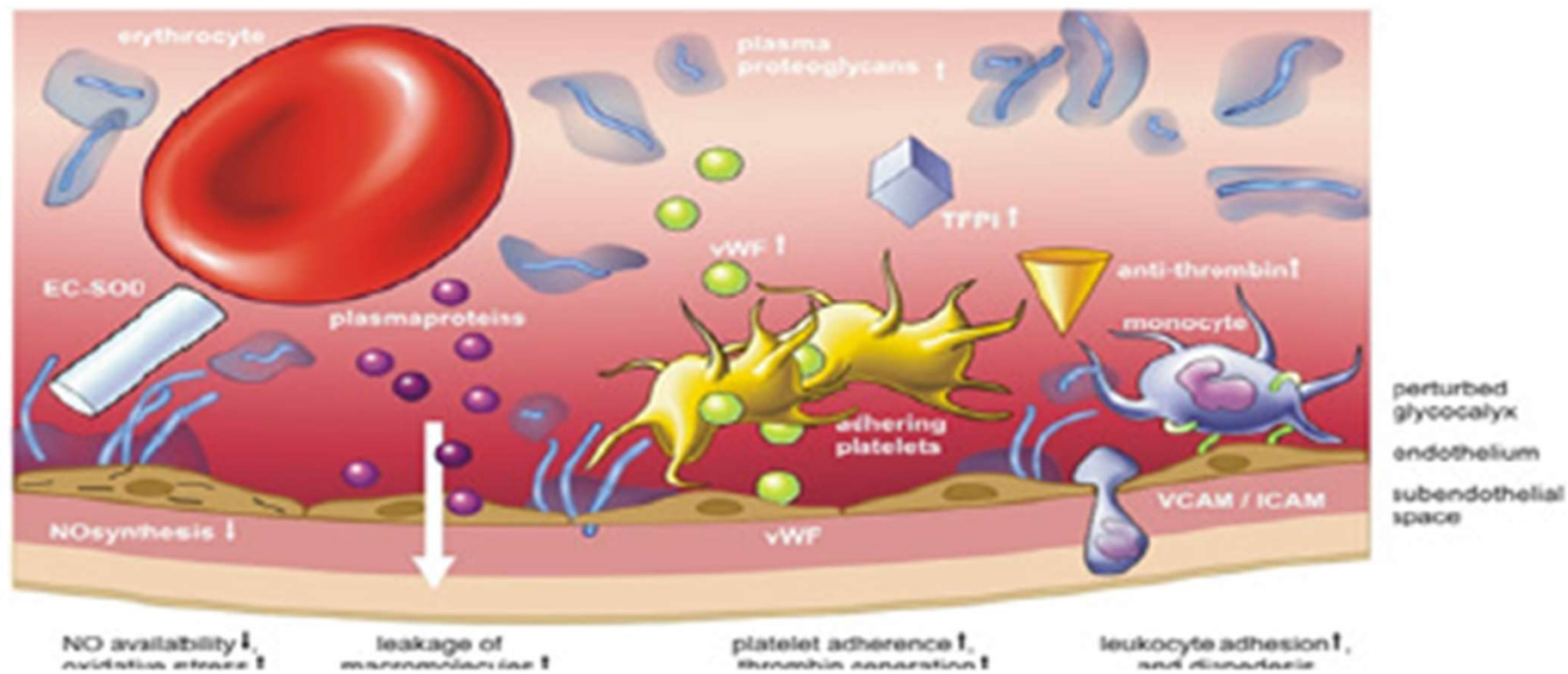
Mitigate Endothelial Injury





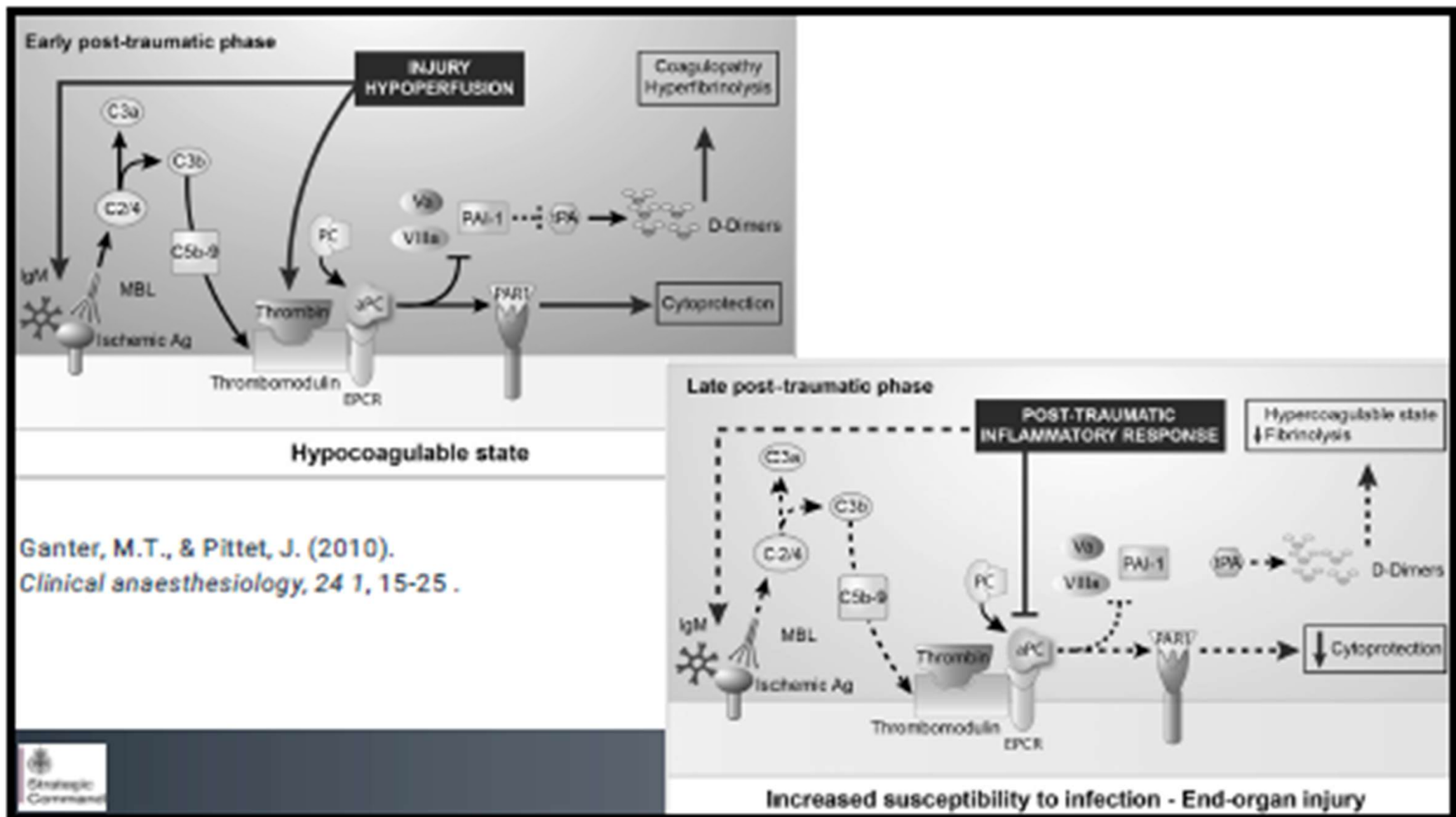
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Ganter, M.T., & Pittet, J. (2010).
Clinical anaesthesiology, 24 1, 15-25 .

MENTAL MODELLING

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1/ Anaesthesia

- Early recognition and declaration
- Prevent exsanguination at 'point of injury'
 - cABC Paradigm / 'Proximal Control'
- Refill the central blood volume
 - Improve DO₂ and reduce the burden of hypoperfusion
- Diagnose, treat and prevent further coagulopathy
- Vigilance for MT side effects and Mitigate

Damage Control Resuscitation



Damage Control Resuscitation

Damage Control Resuscitation is **NOT** the bit before surgery
but occurs concurrently and extends surgical options.



↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
Individually tailored, goal directed resuscitation. Sequencing DCR-DCS based on near patient, real time assessment of tissue perfusion and haemostasis.

Theatre Conduct

- Decision Making and Communications
- Surgical Pause / Damage Control
- Abbreviated Surgery

20 Minute Brief - Surgical/Anaesthesia Comms

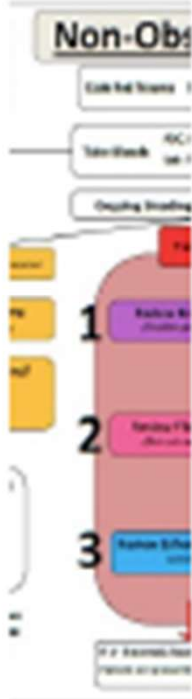
To occur every 20 minutes OR after every 4 units of blood products transfused.

- Time since Knife to Skin (KTS)
- **S**ystolic blood pressure
- **T**emperature
- **A**cidaemia/Serum pH
- **C**oagulation/ROTEM results
- **K**it - Equipment/Total blood products, Used, remaining, required.
- **P**lan i.e. "do we need a surgical pause?"

Targets of Transfusion (Bleeding patient)

- Hb > 10
- PRBC
- INR < 1.5
- FFP
- Ptt > 75
- Ptt
- Fibrinogen > 1.5

ADULT MAJOR HAZARD RESPONSE PROCESS



22 May 20

SWRT Figure 1. Key points of crisis resource management (CRM). At left, back Taunton

Copenhagen Concept

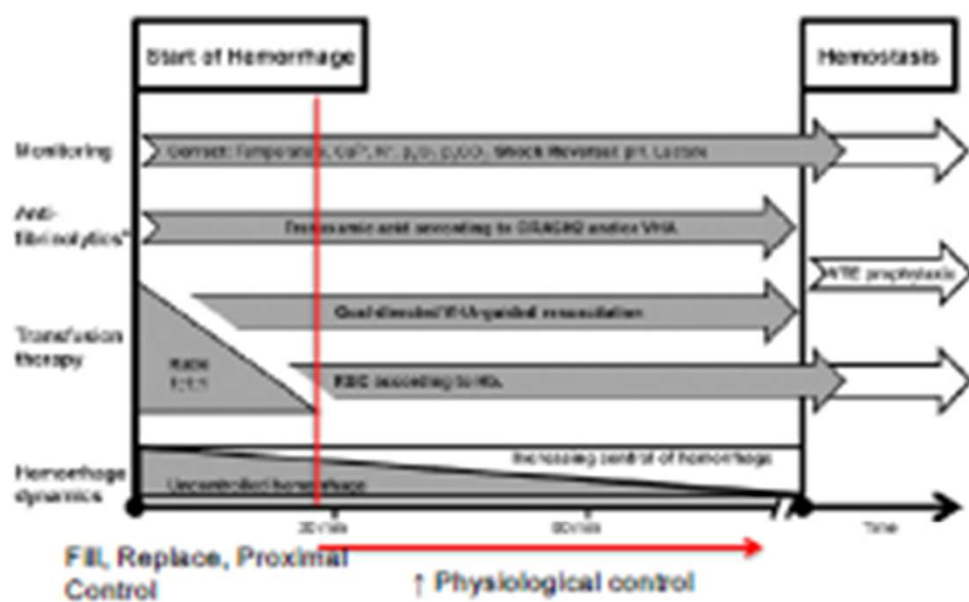
How I treat patients with massive hemorrhage

Pär I. Johansson,^{1,2} Jakob Stenbäck,^{1,2} Roberto Oliver,¹ Charles E. Wade,³ Gisele R. Ostrowski,¹ and John B. Holcomb³

¹Institute for Transfusion Medicine, Capital Region Blood Bank, Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark, ²Department of Surgery, Division of Adult Care Surgery, Centre for Transfusion Research, University of Texas Health Medical School, Houston, TX, and ³The Trauma Centre, Department of Anesthesia, Centre of Head and Orthopedics, Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark

- Massive haemorrhage - major cause of potentially preventable deaths
- Development of coagulopathy ↑↑ the mortality rates
- Existing data indicate that immediate administration of a balanced transfusion therapy with plasma and platelets in addition to RBC reduces mortality in patients with massive haemorrhage

Copenhagen Concept



PATHOPHYSIOLOGY AND GOALS

Pathophysiology

- Reduced circulating volume – baroreceptor and sympathetic (pressor) response **Shock Index / Fluid Response**
- Reduced oxygen flux and shock **BD + Lactate**
- Tissue Damage α Clotting factor, Platelet fibrinogen consumption **?POC / VET**



Coagulopathy Exacerbants

- Ongoing Consumption
- Dilution
- Hormone/Cytokine ECA
- Hypoxia, Acidosis, Hypothermia
- Anaemia



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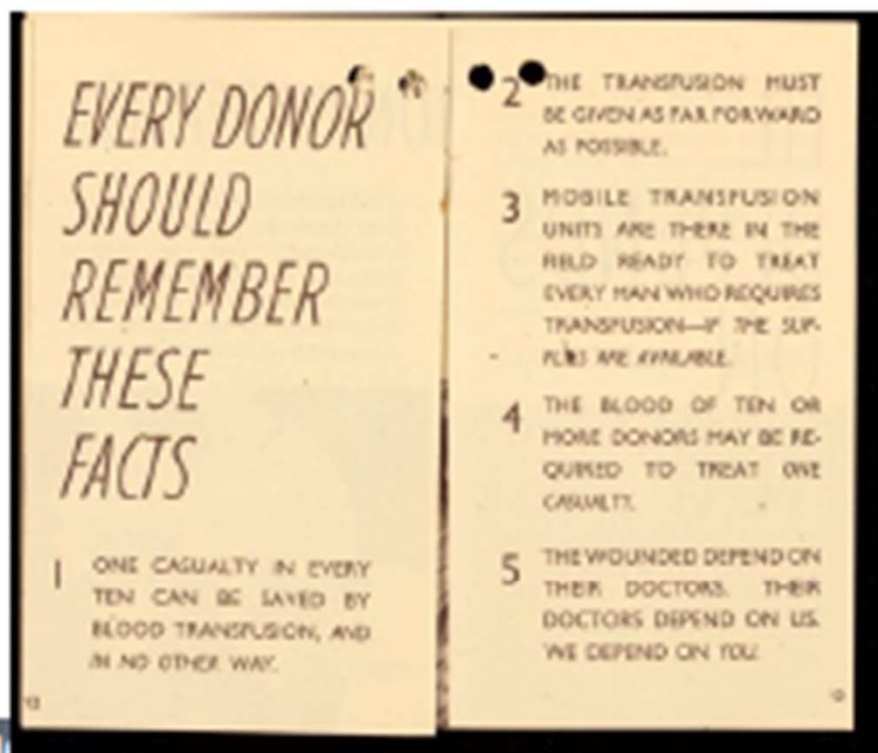
BLOOD FAR FORWARD



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NO SERVICE PERSON SHOULD BLEED TO DEATH WITHOUT RECEIVING BLOOD OR BLOOD PRODUCTS



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Blood Far Forward

NO SERVICE PERSON SHOULD BLEED TO DEATH WITHOUT RECEIVING BLOOD OR BLOOD PRODUCTS

- Haemostatic resuscitation within 30 mins of injury.
 - Blood is best and saves lives.
 - **More options**
 - **More availability**
 - **Farther forward**
- Provide a range of blood components and blood products to right people at the right time.

NO SERVICE PERSON SHOULD BLEED TO DEATH WITHOUT RECEIVING BLOOD

BLOOD FAR FORWARD PROGRAMME

TRAINING

EQUIPMENT

PERSONNEL

INFRASTRUCTURE

DOCTRINE

CLINICAL

ORGANISATION

INFORMATION

LOGISTICS

INTEROPERABILITY

Main pillars

- Whole blood is best
- Increase 'blood options' further forward
 - Type of blood – universal, EDP, group spec (OLO Titre), better media
 - Cold chain
 - Collecting blood
 - Moving blood around
- Need more people able to start a transfusion

The Vision



Any brand specific
products are for
illustration purposes
only

FUTURE INNOVATIONS

Emergency Donor Panels/ OLO

- Non BMS delivered Gp O Lo titre
 - Arm to arm transfusion
- Should we all be donors?

SHOCK, Vol. 41, Supplement 1, pp. 73-76, 2014

LOW TITER GROUP O WHOLE BLOOD IN EMERGENCY SITUATIONS

Gair Strandenes,^{1†} Ole Bersfus,⁴ Andrew P. Cap,⁵ Tor Havig,^{4‡} Michael Reade,¹
Nicolas Pnat,^{6***} Anne Saillot,^{1‡} Richard Gonzalez,^{1‡} Clayton D. Simon,^{1§}
Paul Ness,^{1‡} Heidi A. Doughty,^{7§} Philip C. Spinella,^{8***} and Einar K. Kristoffersen^{4‡}



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Whole Blood


Blood and Transplant


Study of Whole blood
In Frontline Trauma

CENTRE FOR
TRAUMA
SCIENCES 

Landmark UK study launches to save
hundreds more lives

- **Multi centre RCT**

Posted Thursday, 26 October 2018

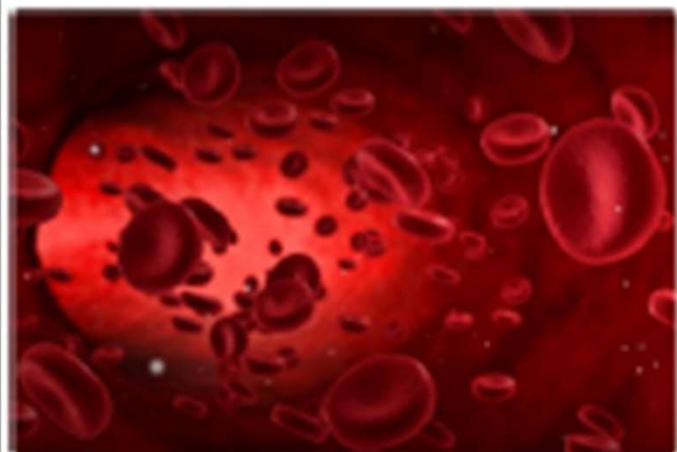
- **6 Air Ambs**

- **?Clinical and Cost effectiveness**



We're launching with a landmark new study which will eventually see medical teams at London's Air Ambulance deliver whole blood transfusions at the roadside to critically injured patients in the capital.

Bioengineered Blood Products



- Improve storage profiles
- Include additional functionality

npj | Regenerative Medicine

www.nature.com/npjregmed

REVIEW ARTICLE **OPEN**

Regenerative medicine and war: a front-line focus for UK defence

Abigail M. Spear¹, Graham Lenton², Robert M. T. Stanuch³ and Roy F. Bakard⁴



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Defence and
Security
Accelerator

Sovereign Capability



Blood and Transplant



abcam



AstraZeneca

NIHR | Wellcome





Quantities of Dried Plasma produced

	1941 (July- Dec.)	1942 (Jan.- Dec.)	1943	1944	1945 (Jan.- May)	Totals
Bottles (400 c.cm.)	9,052	34,299	67,289	63,331	22,890	196,761
Average per week	348	659	1,294	1,218	1,200	



CALL-UP NOTICE TO ALL GROUP "O" BLOOD DONORS IN BRISTOL

WHAT TO DO,

when you receive your call-up card.

(1) If employed, show this card to your employer and ask for the necessary time off (the time required will be approximately 40 minutes, plus time taken to travel to and from the transfusion centre).

(2) Attend at the time specified, **WHATEVER** the INCONVENIENCE.

(3) Do not come until you receive your call-up card. Blood must be taken as and when it is required.

REMEMBER:

(1) Now that the invasion of Europe has started, your services are more important than ever.

(2) Records show that 1 in 10 of all wounded will require a blood transfusion to save them, and that the blood of 10 donors is required to treat one casualty.

(3) The blood donors of Bristol alone can save 25,000 lives.

If you wish to volunteer as a blood donor, send in your name and address and age to:

ARMY BLOOD TRANSFUSION SERVICE

SOUTHMEAD HOSPITAL, BRISTOL